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US EPA Region 8
Denver, CO

Submitted by:
Atlantic Richfield Company
Anchorage, AK
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Quality Assurance Project Plan for Surface Water Sampling

Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01
Rico, Colorado

Atlantic Richfield Company

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April 29, 2011

Mr. Steven Way
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**Subject: Quality Assurance Project Plan (QAPP)
Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01 Rico, Colorado**

Dear Mr. Way,

Please find enclosed three (3) copies of the *Quality Assurance Project Plan* dated April 29, 2011. Atlantic Richfield is submitting the Plan in accordance with Section 5.1 of the Removal Action Work Plan, Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01 Rico, Colorado dated March 9, 2011.

If you have any questions, please feel free to contact me at 406.491.1129.

Sincerely,



Chuck Stilwell, P.E.
Project Manager
Atlantic Richfield Company

Enclosures

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S. Dischler, AR
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C. Sanchez, Anderson Engineering
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QUALITY ASSURANCE PROJECT PLAN FOR SURFACE WATER SAMPLING RICO, COLORADO

April 29, 2011

1.0 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared in concurrence with the Sampling Analysis Plan (SAP)¹ for surface water quality sampling and flow measurement activities within the Dolores River watershed near the Town of Rico, Colorado. The sampling locations and parameters for analysis for this supplemental sampling program have been selected to provide additional data on the St. Louis tunnel discharge, flows at selected locations within the St. Louis settling pond system and at the system discharge (002) to the Dolores River (collectively referred to as the St. Louis ponds system), and previously sampled locations along the Dolores River above, at and below the St. Louis ponds system. Water flow measurements will be performed at each sampling site in conjunction with the water quality sampling. Table 1-1 in the SAP lists the sampling station locations and site descriptions. Figure 1-1 in the SAP illustrates the location of the various sampling stations.

These sample locations were sampled at several intervals from 2003 through 2006 to develop data for the Water Quality Assessment for CDPHE. Atlantic Richfield is interested in determining the current water quality for these locations in order to update the Water Quality Assessment, if necessary, to establish receiving water quality to support the ongoing review of the CDPS discharge permit application and associated permit limits to be developed and to provide discharge water quality parameters to support system design for treatment of the tunnel effluent.

The SAP and QAPP are the two primary guidance documents for field sampling, handling and analysis in Rico. The SAP provides all of the necessary directions for collecting surface water data; the QAPP provides the mechanisms by which the Data Quality Objectives (DQO's) will be achieved. Various guidance, methodology, and procedural documents, primarily authored by the Environmental Protection Agency (EPA), were consulted during the preparation of this QAPP; most notably these include: *EPA Guidance for Quality Assurance Project Plans*².

1. AECOM, November 2010. *Sampling and Analysis Plan for Supplemental Surface Water Quality Monitoring*

2. December 2002, EPA/240/R-02/009. *Guidance on developing Quality Assurance Project Plans that meet EPA specifications for new and existing data.*

3. EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*, July 1996, Office of Water Engineering and Analysis Division, Washington, DC.

2.0 Project Organization and Certification Requirements

Figure 2-1 presents the key positions of project organization including lines of communication. The responsibilities related to these key positions are discussed.

2.1 EPA Remedial Project Manager

The EPA will be acting as the lead agency in the oversight of this project. The EPA project manager will review draft submittals, receive final reports, and will act as liaison between the EPA and Atlantic Richfield.

2.2 CDPHE Project Manager

The CDPHE will provide regulatory oversight for State issues on the project. The CDPHE project manager will also review draft submittals and receive final reports.

2.3 Atlantic Richfield Company, Project Manager

The Atlantic Richfield Project Manager will review all deliverables prior to finalization and submittal and interface with agency managers concerning project deliverables and others issues pertaining to the project

2.4 AECOM Project Manager

The AECOM Project Manager is responsible for designing the sampling program and plans in accordance with agency and project requirements, reviewing field data and preparing final agency deliverables.

2.5 Anderson Project Manager

Anderson's Project Manager is responsible for preparing the QAPP and implementing the plans, conducting and reporting investigations, supplying technical support from field personnel, and responding to any problems that may arise in the completion of the field tasks.

2.6 Task Managers and Field Personnel

The task managers and field personnel will be responsible to ensure that the sampling plan is followed and the data collection and QA goals are met. They will be responsible for following the Site Health and Safety Plan and Control of Work requirements. Any problems encountered in the field will be communicated to the Anderson Engineering Project Manager who in turn will contract client and agency managers as needed

2.7 Subcontractors

Subcontractors will follow the direction of the Anderson Engineering Project Manager or the Project Manager's designee. Subcontractors are expected to develop, implement, enforce,

and comply with all safety regulations and procedures applicable to their equipment and activities. Subcontractor supervisors are responsible for the performance of their field personnel, ensuring that each of their onsite personnel has read and understands the site Health and Safety Plan, and enforcing the site safety requirements.

2.8 Certification Requirements

Personnel performing field work will be required to be appropriately trained according to 29 CFR 1910.120. Field personnel will also receive a project-specific review based on anticipated site responsibilities. A Professional Engineer registered with the State of Colorado will review and approve all design documents prepared during the course of the project.

3.0 Data Quality Objectives and Assessment Procedures

3.1 Data Quality Objectives

The data from field samples collected will include laboratory analyses of surface water samples. As part of the QA/QC process, data quality indicators including precision, accuracy and bias, representativeness, comparability, and completeness (PARCC) will be evaluated as described in Table 3-1. For this project:

- a. Precision - refers to the quantitative measurement of agreement among field duplicate samples;
- b. Accuracy - refers to the quantitative measurement of closeness of an individual measurement to the true value and bias pertains to systematic or persistent distortion in the measurement process;
- c. Representativeness - refers to the qualitative measure of the degree to which the sample data accurately and precisely represent the environmental conditions;
- d. Comparability - pertains to the qualitative assessment that data sets can be directly compared; and,
- e. Completeness - refers to the percentage of valid data.

A summary statement regarding representativeness and comparability will be provided. Note that any available method-specific performance requirements (e. g., tolerances for analytical accuracy, etc.) will take precedence over those listed in Table 3-1 above. Data, for which the QA/QC goals discussed above are not met, may be re-evaluated for acceptance in consultation with the supervising agency.

3.2 Analytical Data Categories

Analytical measurements will be performed using methods appropriate for the selected analysts. Analytical methods will include both “screening” and “definitive” techniques. Screening methods, often performed in the field for rapid data acquisition, usually are performed using less rigorous QC procedures as compared to definitive laboratory techniques which require

additional QC procedures and documentation. For this project, examples of screening methods include field-measured pH and conductivity while definitive analyses of the metals and the remaining analytes are performed in a more controlled laboratory environment. Analytical methods are discussed further in Section 6.0.

4.0 Experimental Design and Sampling Methods

4.1 Experimental Design

For this project, experimental design refers to the sampling strategy and rationale which are discussed in the SAP. After data validation and verification, the resulting data set will be evaluated in terms of project objectives to determine if re-sampling or re-analysis is warranted.

4.2 Sampling Methods

Sample collection will be performed according to methods described in the SAP. Sample size, containers, and preservatives to be used are also described in the SAP. For samples with lower concentrations expected, ultra clean procedures will be followed per EPA Method 1669.

4.3 Field Changes

In some instances, elements of the field program require adjustment in response to site conditions or other circumstances. Typical adjustments include the moving or elimination of a sample site or change in sample collection technique. Significant changes will be reported by field personnel to the project manager. If conditions allow, and if practical, significant changes will be discussed with agency personnel in advance.

5.0 Sample Handling and Chain of Custody

Chain-of-Custody procedures will be followed throughout sample collection, handling and transportation to the selected laboratory. The samples will remain in the custody of the sampler, or in a secure area accessible only to the sampler. A chain-of-custody form will be completed and will accompany the samples to the laboratory. Coolers containing samples will be sealed with a chain-of-custody seal prior to transfer from the site. All persons relinquishing or accepting custody of the samples will be required to sign and date/time the chain-of-custody form. Upon delivery of the samples, the analytical laboratory will copy the form, so that a copy can be kept by the sampler as part of the field records. The chain-of-custody form will also include a listing of the analyses to be requested for each sample. All sample bottles will be clearly labeled with an adhesive label. Samples will either be hand-delivered to the laboratory or shipped as allowed under chain-of-custody procedures.

6.0 Analytical Methods

EPA-approved methods will be used in the analysis of the samples collected. Case narratives will be provided with each analytical data package that discusses details of failures and/or exceptions in maintaining method performance, or other, requirements. Corrective action (e. g., re-analysis or re-calibration) may be required in incidents of unacceptable precision, recovery, instrument calibration, etc. Table 6-1 summarizes the analytical methods to be used.

7.0 Quality Control

Table 3-1 summarizes the QA/QC methods and goals.

7.1 Equipment Blanks

Samples collected for analysis will be collected in disposable containers. Samples will be accompanied by an equipment blank if decontamination of reusable sampling equipment is practiced (i.e. using a pump to collect filtered samples). Equipment blanks check the adequacy of the decontamination procedures used at the site. These samples would receive identification numbers similar to actual samples and will be submitted as normal field samples. Blanks will consist of distilled water over, or run through, the sampling equipment and collected in a clean sample container, after the equipment has been decontaminated. One equipment blank would be prepared and submitted for the same suite of requested analyses as are applicable for the other samples for each sampling event.

7.2 Field Duplicates

Field duplicates are also commonly used in QA/QC protocols. One blind field duplicate will be collected and submitted for metals analysis for every 10 samples or a minimum of one per sampling event.

7.3 Laboratory Procedures

Generally, quality control in the laboratory is guided by the laboratory-specific Quality Assurance Plan (QAP). Specifically, method blanks, laboratory control standards, matrix spikes, and laboratory duplicates are used along with data review and documentation to accomplish QA/QC objectives. In addition, the selected laboratory will use QA/QC procedures routinely used at the laboratory to maintain State of Colorado certification and will use analytical methods and method-specific QA/QC control as described in SW-846.

8.0 Instrument and Equipment Maintenance /Calibration

8.1 Instrument and Equipment Inspection and Maintenance

a. Field Equipment

Field equipment related to the collection of analytical data will include a thermometer, pH meter, conductivity meter, and decontamination equipment. The equipment will be inspected before each use. Equipment found in disrepair will be repaired according to manufacturer's guidance or replaced. Equipment decontamination will be performed as described herein.

b. Laboratory Equipment

Inspection and maintenance of laboratory equipment is performed according to the laboratory's QAP which will be submitted under separate cover.

8.2 Instrument and Equipment Calibration

a. Field Instruments and Equipment

The pH meter will be calibrated once each day (before use), at a minimum, using standards (pH buffers) recommended by the manufacturer. The recommended standards are typically pH's of 4, 7, and 10. In addition, the pH 7 standard will be used before each sample measurement. Proper calibration is considered to be attained if standards read within 0.1 pH unit. If proper calibration is not achieved, recalibration will be repeated and equipment adjusted/replaced as necessary.

The conductivity meter will be calibrated once each day (before use), at a minimum, using a KCl standard solution. Proper calibration is considered to be achieved when within 10% of the standard concentration. If proper calibration is not achieved, recalibration will be repeated and equipment adjusted/replaced as necessary.

b. Laboratory Instruments and Equipment

Laboratory instruments and equipment will be calibrated according to manufacturer's specifications and will comply with the laboratory's QAP and with any method-specific performance requirements that may apply.

9.0 Requirements for Supplies and Consumables

9.1 Field Supplies and Consumables

Field supplies and consumables will include calibration fluids, decontamination fluids, water for equipment blanks, and plastic bags or sheets to keep decontaminated equipment clean before use. Materials that are visibly contaminated will not be used and will be replaced. If contaminated materials are identified, suppliers and/or handling procedures will be re-evaluated as appropriate. At a minimum, distilled water will be used for the preparation of equipment blanks. Purer grades of water may be selected for this purpose. If measurable concentrations of the metals of concern are reported in an equipment blank, the water will be tested, and replaced and the source re-evaluated, as appropriate. The analytical results of the water supply will then be evaluated and any effect on the integrity of the surface water sample results assessed.

9.2 Laboratory Supplies and Consumables

The laboratory's QAP and any applicable method-specific requirements will guide the QA/QC aspects related to laboratory supplies and consumables.

10.0 Data Acquisition Requirements

Any data used from non-direct measurement sources such as computer databases, programs, literature files, and historical databases will be reviewed for representativeness, bias, and precision. Any limitations on the use of the data resulting from uncertainty in its quality will be evaluated. The rationale for the original collection of the data and its relevance to the project will also be addressed.

11.0 Information Management and Reporting

11.1 Data Flow and Document Control

All data, reports, and related products generated during this project will be stored in project files maintained at the Atlantic Richfield office in Butte, Montana. The files will also include original laboratory reports and relevant historical information which has contributed to project decision-making. Readily available public information used during the course of the project may not be included in the project files. An extra set of field data, reports and related products generated during this project will also be stored on CD media at Anderson Engineering's office in Salt Lake City, Utah.

Data will be electronically managed with spreadsheets and will be transferred as required between Atlantic Richfield, Anderson Engineering, AECOM, EPA, and CDPHE using hard copy, disks, and/or e-mail. After project closure, all data, files, and other materials to be permanently filed will be inventoried. The files will be maintained permanently by Atlantic Richfield.

Electronic backup of data and related project documents will typically be performed every time the data files are closed after being used. These frequent backups will be made on hard drives or other appropriate storage devices. Final backup copies will be made available on CDs.

11.2 Data Reduction

The methods of assuring accuracy of data reduction, including hand calculation and computer-assisted methods are described below. Technical personnel will document and review their own work and are responsible for its correctness. Critical data reduction and calculations will be checked by senior project management.

a. Hand Calculations

Hand calculations will be recorded and adequately described in proper context so that the work may be readily understood and recreated at a later date. Major calculations will be checked by senior project management.

b. Computer Analysis

Computer analysis, including calculations, modeling, etc. may be used during the course of the project. The correctness of such data reduction will be evaluated in a professional manner using a level of skill and care exercised for similar projects under similar conditions by environmental consultants.

12.0 Assessment and Oversight Elements

Assessment of QA/QC procedures will be performed as discussed throughout this QAPP. Those procedures, which are based on EPA guidance, are intended to provide the degree of internal control appropriate to the anticipated scope of work. No additional assessment or oversight, including audits of field or laboratory procedures, are planned.

In instances where data quality does not conform to QA/QC goals, the need for corrective action will be evaluated by the Project Manager. Examples of corrective actions related to the field and laboratory operations planned for this project could include re-sampling, re-analysis, or re-calculation during data reduction. Corrective actions will be documented and results evaluated for compliance with project objectives.

13.0 Data Review, Validation, and Verification

13.1 Data Review

The data generated from this project on which decisions and recommendations are based will be reviewed for completeness and accuracy as described throughout this document. Any data found to be incomplete or inaccurate will be discarded or selected for provisional use only.

13.2 Data Validation and Verification

Validation and verification will consist of examination of documents resulting from field and laboratory activities to ensure that the data are adequate for their intended use. Table 13-1 summarizes the elements of data validation and verification. Generally speaking, data validation and verification for this project will consist of selecting applicable elements from Tables 3-1 and 13-1.

Specifically, field methods and screening measurements will be reviewed for compliance with collection and handling procedures as described in the SAP and the QAPP. These methods and data will not be validated and verified by formal EPA validation methods. However, an overall evaluation of usability will be made.

A formal data validation will be performed on the definitive data by independent qualified personnel according to EPA's National Functional Guidelines (EPA, 2008) as related to method-specific requirements and acceptance criteria discussed in this document. Overall, 10% of the definitive data will be validated. Data validation qualifiers will be applied to definitive data as follows:

J	Estimated positive result
NJ	Tentatively identified at an estimated value
N	Tentatively identified
R	Rejected/unusable
U	Undetected
UJ	Undetected at an estimated value

The purpose of this formal validation process is to identify data that is unacceptable for its intended purpose. Such data will either be eliminated from the decision-making process or qualified for limited use (e.g., approximation purposes). An assessment of data usability will be prepared for the definitive data.

13.3 Data Quality Assessment

The results of the QA/QC methods implemented during the project will be evaluated and summarized. An assessment of overall data usability will be prepared.

Table 3-1 Data Assessment Procedures: QA/QC Methods and Goals

Parameter	Location	QC Program	Evaluation Criteria	QA/QC Goals
Precision	Field	Field duplicate pairs	Relative Percent Difference (RPD) ¹	RPDs will be $\pm 20\%$ when detected concentration is $>10\times$ the Detection Limit (DL); when the detected concentration is $< 10\times$ the DL, the RPD limit will be \pm DL.
Accuracy	Field	Method blanks	Detection limit	$<DL$
		Equipment blanks	Detection limit	$<DL$
Accuracy	Lab	Initial Calibration and Calibration Verification Blanks (ICB/CVB)	Detection limit	$<DL$ (verified in case narrative)
		Initial Calibration and Continuing Calibration Verification	Percent recovery	85%-115% (verified in case narrative)
		Laboratory Control Sample (LCS)	LCS percent recovery ²	Percent Recovery Limit for LCS is 80%-120%
		Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Percent Recovery ³ and RPD	Percent Recovery Limit for MS/MSD is 75%-125%. The RPD limit for MS/MSD is $\pm 20\%$.
Representativeness	Field	Sampling methods described in site investigation plan	Were sampling methods adhered to?	All samples collected by described methods.
		Planned timely sample handling, prep, and analysis	Required holding times	All laboratory work performed within required holding times.
		Field/equipment blanks	DL	Results \leq DL
Comparability	Office	Proposed consistent units of measurement	Are comparable units used in evaluations?	100% of results reported in the same units
Comparability	Lab	Proposed analytical methods	Were approved methods used?	100% use of approved methods
Comparability	Field	Standardized sampling methods	Proposed sampling methods adhered to?	100% use of proposed (i.e., approved) methods
		QC samples 20% field duplicates 20% field blanks Lab QA	Were the samples collected as proposed?	Samples were collected as proposed.
Completeness	Office	Validation to be performed	percent valid data	90% valid data

¹RPD = $((X_1 - X_2) / ((X_1 + X_2) / 2)) \times 100$

²LCS Percent Recovery = $X_1 / X_u \times 100$; where X_1 = measured concentration and X_u = known concentration.

³Percent Recovery = $\%R = ((X_S - X_1) / SC) \times 100$; where X_S = detected concentration in spiked sample, X_1 = measured concentration prior to spiking, and SC = spike concentration.

Table 6-1 Sampling and Analytical Protocol Information: Surface Water

Analyte	Method	PQL	Container Type	Preservation	Holding Time
Field Parameters					
Dissolved Oxygen	SM 4500-OG	+/- 2% Full scale (MDL)	500 ml HDPE	4° C	Analyze immediately
pH	EPA 150.2	+/- 0.01 pH (MDL)			Analyze immediately
Temperature (°C)	Standard Method 2550	+/- 1°C (MDL)			Analyze immediately
Electrical Conductivity (µmhos/cm)	EPA 120.1	+/- 2% Full scale (MDL)			Analyze immediately
General Parameters					
Alkalinity (mg/L as CaCO ₃)	EPA 310.1	20 mg/L	500 ml HDPE	NaOH	
Hardness (mg/L as CaCO ₃)	EPA 130.2 or SM 2340 B	0.5 mg/L			
TDS	SM 2540C	5.0 mg/L			7 days
TSS	SM 2540D	5.0 mg/L			
Cyanide (CN)	EPA 335.4	0.005 mg/L			
Sulfate (mg/l as SO ₄)	EPA 300.0	1 mg/L			
Salinity	SM 2510B (calculated)	6 mg/L			
Total and Dissolved Metals Prep.	3015 (total) 3005 (diss.)		500 ml HDPE (one bottle for totals; one bottle, filtered, for dissolved)	HNO ₃ <2	6 months*
Aluminum (Al)	M 200.8ICP-MS	75 µg/L			
Antimony (Sb)	M 200.8ICP-MS	10 µg/L			
Arsenic (As)	M 200.8ICP-MS	10 µg/L			
Barium (Ba)	M 200.8ICP-MS	10 µg/L			
Beryllium (Be)	M 200.8ICP-MS	1.0 µg/L			
Cadmium (Cd)	EPA 200.8 ICP-MS	5.0 µg/L			
Calcium (Ca)	M 200.7 ICP	100 µg/L			
Chromium (Cr)	EPA 200.8 ICP-MS	0.25 µg/L			
Copper (Cu)	EPA 200.8 ICP-MS	0.25 µg/L			
Iron (Fe)	EPA 200.7 ICP	50 µg/L			

Analyte	Method	PQL	Container Type	Preservation	Holding Time
Lead (Pb)	EPA 200.8 ICP-MS	0.05 µg/L			
Magnesium (Mg)	M 200.7 ICP	50 µg/L			
Manganese (Mn)	EPA 200.8 ICP-MS	0.25 µg/L			
Mercury (Hg)	SW 7470A	0.2 µg/L			
Nickel (Ni)	EPA 200.8 ICP-MS	0.25 µg/L			
Potassium (K)	M 200.7 ICP	500 µg/L			
Selenium (Se)	EPA 200.8 ICP-MS	0.25 µg/L			
Silver (Ag)	M 200.7 ICP	0.25 µg/L			
Sodium (Na)	EPA 200.8 ICP-MS	500 µg/L			
Thallium (Tl)	M 200.8ICP-MS	0.25 mg/L			
Vanadium (V)	M200.8ICP-MS	0.05 mg/L			
Zinc	EPA 200.7 ICP	50 µg/L			

DL=detection limit; HDPE = high density polyethylene; PQL = Practical Quantitation Limit; * 28 days for mercury. Note that all samples will be placed in a cooler with ice immediately after collection.

Table 13-1
Summary of Data Validation and Verification Requirements and Methods

Requirements	Methods
Samples are collected as per approved locations and frequency	Check Sampling and Analysis Plan
Sample collection and handling followed approved procedures and chain-of-custody requirements	Review field notes and chain-of-custody documentation.
Appropriate analytical methods were used and internal laboratory calibration checks were performed according to method-specific protocol.	Review analytical methods and case narratives. Document communications with laboratory regarding problems/corrective actions.
Required holding times and laboratory- reporting limits were met.	Review specified holding times and DLs.
Recovery acceptance limits for field and laboratory QC samples (MS/MSDs, LCS, and method blanks) were met.	Tabulate RPDs and percent recoveries and compare to laboratory-acceptance limits and PARCC parameters.
Appropriate steps were taken to ensure accuracy of data reduction and presentation.	Maintain laboratory reports on file and check work products.

Figure 2-1
Key Positions of Project Organization

